Efficient Degradation of Fluorinated Pesticides in Water Using Electrochemical Oxidation with Boron Diamond Electrodes

Pesticide use in agriculture has led to increased crop production but has also contaminated surface water, posing a threat to drinking water quality. Emerging fluorinated pesticides, known for their effectiveness, have been detected in drinking water sources. Electrochemical oxidation (EO) using boron diamond electrodes has shown promise in degrading organic compounds in water, but its effectiveness against fluorinated pesticides, which feature resilient carbon-fluoride bonds, remained uncertain.

This study examined the degradation of Fluroxypyr, Florasulam, and Penoxsulam under varying conditions, including electrolyte concentrations (1-100 mM Sodium Sulfate), current densities (5-100 mW/cm^2), flow rates (2-8 L/min), and pesticide concentrations (0.1-10 mg/L). Different water matrices were also considered.

Results indicated EO's efficiency in degrading fluorinated pesticides, with half-lives of 16.5, 17.6, and 25.1 minutes for Fluroxypyr, Florasulam, and Penoxsulam, respectively. Degradation depended on current densities, water matrices, and electrolyte concentrations, while pesticide concentrations and flow rates had limited impact. Ongoing research will identify final byproducts to ensure they are not harmful replacements for the degraded pesticides. This study provides compelling evidence for EO's potential in removing fluorinated pesticides, aiding water treatment facilities in organic removal decisions, crucial for preserving water quality.